Appendix G

Flora and Fauna Assessment

Flora and Flora Assessment – Resource Recovery and Recycling Facility, Rutherford

January 2006

Transpacific Industries

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited ACN 078 004 798 and
Parsons Brinckerhoff International (Australia) Pty Limited ACN 006 475 056
trading as Parsons Brinckerhoff ABN 84 797 323 433

PPK House
9 Blaxland Road
Rhodes NSW 2138
Locked Bag 248
Rhodes NSW 2138
Australia
Telephone +61 2 9743 0333
Facsimile +61 2 9736 1568
Email sydney@pb.com.au

ABN 84 797 323 433
NCSI Certified Quality System ISO 9001

2118506A
App G Flora and Fauna

Author: Nicholas Corkish

Reviewer: Martin Predavec

Approved by: Wayne Jones

Signed:

Date: 17 June 2005

Distribution: PF Formation, PB File

Contents

Page Number

List of Tables

Appendices

Acronyms and Abbreviations

EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
TSC Act	*Threatened Species Conservation Act 1995*
EIS	Environmental Impact Statement
DEC	NSW Department of Environment and Conservation
DEH	Commonwealth Department of Environment and Heritage
LGA	Local Government Area
LEP	Local Environment Plan
SEPP	State Environmental Planning Policy
ROTAP	Rare or Threatened Australian Plant

Executive Summary

Transpacific Industries is planning to develop a site, covering an area of approximately 10.2 hectares, at Rutherford west of Maitland, as a resource recovery and recycling facility. The proposed site was inspected to assess the vegetation and fauna habitats present and threatened species with respect to the potential impact of the proposed development on these features.

A number of large buildings, tanks, roads and other facilities remain on the site from previous uses and the majority of the remainder of the site has been previously cleared and is dominated by introduced grasses and herbaceous weeds. However, the site includes four small, highly degraded, remnants of native vegetation that meet the definitions of Endangered Ecological Communities listed under the NSW Threatened Species Conservation Act 1995. These communities are Lower Hunter Spotted Gum–Ironbark Forest and Hunter Lowland Redgum Forest. An assessment of the significance of the impact of the development on the Endangered Ecological Communities, in accordance with section 94 (the 'Eight Part Test') of the Threatened Species Conservation Act 1995 indicates that the development poses no significant impact to these communities.

Although one threatened species, the Grey-headed Flying-fox is known to utilise the site for foraging no threatened plant or animal species or population is considered likely to be significantly affected by the proposed development.

1. Introduction

1.1 Purpose

Parsons Brinckerhoff (PB) was engaged by Transpacific Industries to prepare an Environmental Impact Statement (EIS) for the Resource Recovery and Recycling Facility, Kyle Street, Rutherford. The EIS was required to include a desk-based review of available ecological information and a brief site inspection in order to determine the likely presence of threatened species, population and communities as listed under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 Study area and project background

For the purpose of the report and assessment the following definitions apply:

Subject site: the area that is proposed for development or activity

Study area: the subject site and any additional areas that could potentially be affected by the proposal either directly or indirectly

Locality: the area within a 20 kilometre radius of the study area

Region: a bioregion defined in a national system of bioregionalisation. For this study this is the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995).

1.2.1 Site location and physical characteristics

Transpacific Industries are proposing to construct and operate a Resource Recovery and Recycling Facility at Kyle Street, Rutherford. The subject site was originally established as a munitions factory in 1943. From 1945, the site and its buildings formed part of a major textile manufacturing facility which spread across a number of adjoining allotments until its closure in 2000. A number of large buildings, tanks and other non-vegetated facilities remain on the site. The site is located within an industrial area, and is zoned General Industry 4(a) under the Maitland Local Environmental Plan. The subject site is approximately 10.2 hectares in area, being approximately 435 metres long x 235 metres wide.

1.2.2 Proposed development action

The proposed plant incorporates green waste, liquid waste and waste oil reprocessing and a vehicle servicing workshop. The purpose of the facility will be to store, treat, recycle, recover and transport most industrial wastes generated within the region.

It is proposed that the facility will incorporate the following units:

- Oily water and waste oil receival, storage and treatment plant;
- A chemical fixation, stabilisation and solidification(CFS) plant for non-sewerable industrial wastes;
- Base oil hydrogenation plant;
- Dangerous goods drum and packaged store;
- Industrial cleaning operations;
- Soil conditioner manufacturing plant;
- Effluent pond;
- Workshop; Administration building incorporating offices and a laboratory; and
- Truck depot.

The area is within the Sydney Basin Bioregion (Thackway and Cresswell 1995) and is located within the North Coast botanical subdivision (Anderson 1961, 1968).

It was assumed that the removal of all existing vegetation within the site may be required.

2. Survey

2.1 Personnel and licensing

The names and qualifications of personnel involved in this assessment and report preparation are shown in *Table 2.1* and a résumé of relevant experience is included as Appendix A.

Table 2.1: Personnel involved in preparing this report

Name	Qualifications	Years Experience	Role
Nicholas Corkish	B.For.Sc.	9	Ecologist

All work was carried out under a Department of Environment and Conservation Scientific Licence (S10445) and a New South Wales Department of Primary Industries Animal Research Authority (AW01/1380).

2.2 Database searches and literature reviews

All relevant and available documents were reviewed for information on surrounding land uses and the presence of vegetation communities of flora and fauna.

Records of threatened species of plant and animal listed under the TSC Act were obtained from the Department of Environment and Conservation (NSW) Atlas of NSW Wildlife (accessed 2 June 2005) for an area within a 20 kilometre radius of the study site. Records of threatened species, populations and communities and migratory species listed under the EPBC Act that could potentially occur in the area were obtained from the Department of Environment and Heritage (2005) Protected Matters Search Tool (accessed 2 June 2005) for an area within a 20 kilometre radius of the study area. Details of the accuracy of each database are shown in Appendix B.

A review of other available data, literature and material was undertaken including:

- aerial photographs;
- ground photographs; and
- broad vegetation mapping (Lower Hunter and Central Coast Regional Environmental Management Strategy 2003)

2.3 Survey method and effort

The site at Rutherford was surveyed on 2 and 3 June 2005 during which the weather was warm in the daytime with maximum daily temperatures ranging between 21 and 25 degrees Celsius and nightly temperature reaching as low as one degree Celcius.

2.3.1 Vegetation and flora survey

A floristic and condition survey of the vegetation of the site, especially of native vegetation remnants, and targeted survey for threatened species of plant was carried out in accordance with flora survey guidelines for cleared sites in the Lower Hunter Central Coast Region (Lower Hunter and Central Coast Regional Environmental Management Strategy 2002). Flora surveys were conducted using the random meander technique as described by Cropper (1993). Species encountered were recorded, providing a species list of the area.

Three categories are used to describe the condition of vegetation communities:

Good: Vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact ground cover, shrub and canopy layers.

Moderate: Vegetation generally still retains its structural integrity but has been highly disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants.

Poor: Vegetation that has lost most of its species and is significantly modified structurally. Often such areas now have a discontinuous canopy of the original tree cover, very few shrubs and exotic species, such as introduced pasture grasses or weeds, replacing much of the indigenous ground cover. Environmental weeds are often co-dominant with the original indigenous species. It can often be difficult to assign a vegetation type to such remnants as they are so species poor.

2.3.2 Fauna survey

Fauna surveys in the study area included both general habitat based surveys and targeted surveys for threatened species of animal conducted in excess of fauna survey requirements for cleared sites recommended in the Lower Hunter Central Coast Region (Lower Hunter and Central Coast Regional Environmental Management Strategy 2002). Opportunistic records of fauna species, including those from scats, tracks and other signs, were also made during targeted fauna surveys and vegetation surveys.

The condition of fauna habitats were assessed by examining characteristics such as native vegetation, ground and litter layers, breeding, nesting, feeding and roosting resources and evidence of fauna presence. The following categories were used to describe the condition of fauna habitats:

Good: A full range of fauna habitat components are usually all present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.

Moderate: Some fauna habitat components are often missing (for example, old-growth trees, fallen timber), although linkages with other remnant

habitats in the landscape are usually intact, although sometimes degraded.

Poor: Many fauna habitat elements in low quality remnants have been lost, including old-growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

Species encountered during targeted surveys and opportunistically were recorded, providing a species list of the area. It should be noted that while recording threatened species within survey results can confirm their presence in a study area, the lack of threatened species records cannot necessarily be used to argue for the absence of the species from the site when suitable habitat is present: by the very nature of their rarity, threatened species are often difficult to detect. Suitable habitat is therefore the most important factor to consider when determining the potential presence of threatened species.

2.3.2.1 Targeted surveys

Targeted surveys were used to supplement the habitat-based assessment and these are detailed below. Targeted surveys were focussed on the three remnants of native vegetation remaining on site.

Spotlighting

Spotlighting for arboreal and ground-dwelling mammals and amphibians was undertaken for 1.3 hours on one night by one person on foot using a handheld 100 watt spotlight with light-adjusting dimmer switch. The speed of survey was slower than one kilometre per hour. The species of any sighted animal was identified.

Anabat recordings

An Anabat Z-CAIM recorder was used to record and identify the ultrasonic echo-location calls of microchiropteran bats and was placed at a single site on one night from dusk until after dawn. Recorded calls were analysed by Ray Williams of Ecotone Pty Ltd.

Diurnal bird surveys

Diurnal bird survey was carried out by one person for more than two hours commencing at 6:40 am on 3 June 2005. Conditions for survey were excellent with good light and no wind.

Incidental sightings

Species of animal present in the study area were recorded through observation methods including incidental sightings, bird surveys, spotlighting, identification of bird and frog calls, searches for ground-dwelling reptile species under logs and leaf litter, and by sighting indirect evidence of species presence such as scats, feathers, tracks and hair.

2.4 Conservation significance

Assessment of the conservation significance of native flora and fauna is done according to the hierarchy:

- International;
- National;
- State;
- Regional; and
- Local.

Meaningful comparisons of significance or value at a variety of scales rely on widely accepted criteria (for example, International Union for the Conservation of Nature 2001). The following criteria were used to assign the site to an appropriate conservation significance category:

International: Important areas of habitat for migratory species covered under international agreements to which Australia is a signatory, such as the China Australian Migratory Bird Agreement (CAMBA), Japan Australian Migratory Bird Agreement (JAMBA), Bonn Convention and Ramsar Wetlands Convention. Also World Heritage properties that contain natural heritage considered to be of outstanding value to humanity as listed under the *Convention Concerning the Protection of the World Cultural and Natural Heritage*. These matters are dealt with under the *EPBC Act*.

National: Remnant ecosystems containing populations of plant or animal species considered nationally vulnerable or endangered and listed under the *EPBC Act*. This category also includes:

- Plants listed as threatened and rare in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996); and
- species listed as endangered, vulnerable or rare in Australia in an Action Plan published by the Department of Environment and Heritage.

State: Remnant ecosystems containing populations of plant or animal species, or vegetation or animal communities considered threatened in New South Wales, including species and communities listed under the *TSC Act*. This category also includes plants listed as poorly known in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).

Regional: There are no widely accepted criteria for regional significance in New South Wales. The state is divided into bioregions (Thackway and Cresswell 1995) and much of the listing of Endangered Ecological Communities under *TSC Act* and the *EPBC Act* are based around these regions. The New South Wales Government has set up Catchment Management Authorities that will direct natural resource management within thirteen general catchments. These authorities will incorporate earlier Regional Vegetation Management Plans that were required under the *Native Vegetation Conservation Act 1999*. In addition, numerous published studies and vegetation mapping projects have indicated the importance of vegetation and species at various spatial scales (e.g. Native Vegetation of the Cumberland Plain, NSW National Parks and Wildlife Service 2002).

Local: All remnant native vegetation and fauna habitat that does not fall into the categories above is considered to be of at least local significance as most such areas have been reduced in extent since European settlement. The overall significance of the site on a local scale can take into consideration factors such as the size of remnants, degree of intactness and connectivity.

Potentially Significant: Often, time constraints, the limitations of field methods or seasonal factors make it impossible to confirm the presence of a significant plant and animal species or populations. However, the habitat of an area being investigated may closely match that used by the significant species in areas nearby where it is known to occur. In these circumstances, the level of significance that would otherwise apply is qualified by "potential". In addition, some species or communities may possess characteristics that make them eligible for listing as threatened at either the State or National levels, although the listing has not taken place. Again, the level of significance for these species and communities is qualified by the term "potential".

2.5 Impact assessment

Subject species for which tests for significance were completed were determined based on the following criteria.

- species recorded in the study area (as defined in Section 1.2) and for which important microhabitat elements will be removed or modified; and
- species recorded in the locality (as defined in Section 1.2) that have potential to occur within the study area and for which important microhabitat elements will be removed or modified.

For species, populations and communities listed under the *TSC Act*, significance assessments (Eight Part Tests) were carried out as required under Section 94 of the *Threatened Species Conservation Act* and Section 5A of the *Environmental Planning and Assessment Act 1979* and followed the methods suggested by the New South Wales Department of Environment and Conservation Information Circular on Threatened Species Assessment (NSW National Parks and Wildlife Service 1996).

For species and communities listed under the *EPBC Act*, significance assessments followed the administrative guidelines of the Department of Environment and Heritage (Environment Australia 2000).

The impact of the proposed works was assessed further under the State Environmental Planning Policy 44 – Koala Habitat Protection.

2.6 Limitations

The study was by design a habitat based assessment; therefore, only limited targeted surveys for threatened species were carried out. This is a conservative approach given that surveys were undertaken outside the flowering/ activity period of some threatened species. The surveys were undertaken during a drought, affecting the favourable microhabitat conditions of invertebrate during targeted searches. Throughout the study area, varying degrees of uniformity of flora and fauna habitats are encountered. Hence no sampling technique can totally eliminate the possibility that a species is present on site (e.g. species of plant present in the seed bank). The conclusions of this report are based upon available data and the field surveys and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.

2.7 Taxonomy

Names of plants used in this document follow Harden (1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2004). Names of vertebrates follow the Census of Australian Vertebrates (CAVS) data maintained by Environment Australia (2003).

3. Legislation

Commonwealth and State legislation and planning policies for the protection of flora, fauna and biodiversity relevant to this project and site includes:

- *Environmental Protection and Biodiversity and Conservation Act 1999* (EPBC Act)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Native Vegetation Conservation Act 1997 and Native Vegetation Act 2003*
- State Environmental Planning Policy 44 – Koala Habitat Protection

Environmental Protection and Biodiversity and Conservation Act 1999

Under the EPBC Act approval is required for developments or actions that:

- will have a significant impact on Matters of National Environmental Significance including nationally listed Endangered Ecological Communities, threatened species and migratory species.
- are likely to have a significant impact on the environment on Commonwealth land when this action is taken outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land.

With respect to the first point, the proposal does not affect any Endangered Ecological Communities listed under the Act, but there are several threatened or migratory species listed under the Act that have been considered in Section 4.

With respect to the second point, the development is not likely to impact significantly on the environment of Commonwealth land.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* requires that any vulnerable or endangered flora or fauna species, populations or ecological communities associated with a proposed development be identified and that acceptable recovery and management strategies be implemented, if a proposal is considered to have a significant impact.

The Act requires that a Species Impact Statement (SIS) be prepared if it is determined under Section 5A (the eight part test) of the *Environmental Planning and Assessment Act 1979* that there is likely to be a significant impact on a threatened species, population or ecological community.

There are two vegetation communities in the proposed site that may meet the definitions of Endangered Ecological Communities under the Act. These are further considered in Section 4.1.

There are several threatened species listed under the Act that have been considered in Sections 4.1 and 4.4.

Key Threatening Processes

Key threatening processes are listed under Schedule 3 of the TSC Act and also under the EPBC Act. Clearing of native vegetation is listed as a key threatening process under the TSC Act and land clearance is listed under the EPBC Act. Removal of dead wood, dead trees and logs is listed as a key threatening process under the TSC Act.

Critical Habitat

Critical Habitat is listed under both the TSC Act and EPBC Act and both the State and Federal Director's General maintain a register of this habitat. Critical habitat is the whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an Endangered Ecological Community that is critical to the survival of the species, population or ecological community (NPWS, 1996).

Native Vegetation Conservation Act 1997 and *Native Vegetation Act 2003*

The *Native Vegetation Conservation Act 1997* provides the framework for the conservation and sustainable management of native vegetation in NSW. It aims to increase and improve vegetation cover by preventing inappropriate clearing, establishing new areas of vegetation and educating the community in the conservation and management of native vegetation. Under the *Native Vegetation Conservation Act 1997*, clearing of any native vegetation greater than 2 hectares in area requires development consent from the Department of Infrastructure, Planning and Natural Resources.

As the amount of clearing of native vegetation within the site under the development proposal would not exceed two hectares, consideration under the Act is not required.

State Environmental Planning Policy 44 – Koala Habitat Protection

Maitland City Council is identified on Schedule 1 of State Environmental Planning Policy 44 (Koala Habitat Protection) (SEPP 44) as a local government area in which this environmental planning instrument applies. An assessment of the Koala habitat potential of the land in accordance with (SEPP 44) is required for potential koala habitat, defined as "areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 percent of the total number of trees in the upper or lower strata of the tree component". This will apply in some areas of the site where the nominated feed tree species, forest red gum *Eucalyptus tereticornis*, makes up more than 15 percent of the trees. Core Koala habitat is defined as "an area of land with a resident breeding population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population". Core Koala habitat requires that a site-specific Koala plan of management accompanies any development application. However, given the paucity of Koala records within ten kilometres of the site, core Koala habitat is unlikely to occur within the site.

4. Results

4.1 Vegetation communities

A number of large buildings, tanks, roads and other facilities remain on the site from previous uses so that approximately one fifth of the site is not vegetated. Of the remainder the majority has been previously cleared and is dominated by introduced grasses and herbaceous weeds, such as *Cynodon dactylon* (Couch Grass), *Trifolium repens* (White Clover), *Chloris gayana* (Rhodes Grass), *Paspalum dilatatum* (Paspalum), *Panicum maximum* var *maximum* (Guinea Grass), *Setaria gracilis* (Slender Pigeon Grass), *Sida rhombifolia* (Common Sida), *Plantago lanceolata* (Lamb's Tongues), *Sporobolus africanus* (Parramatta Grass), *Verbascum* sp. (Mullein), *Ricinus communis* (Castor Oil Plant) and *Ambrosia* sp. (Ragweed). Much of the site is maintained in a mown condition. Within this area a few isolated large trees remain standing and two close lines of *Casuarina cunninghamia* (River She-oak), *Eucalyptus* spp., and *Grevillea robusta* (Silky Oak) trees have been planted along the eastern side of the existing buildings.

Otherwise only four small and highly modified remnants of native vegetation remain on site.

Remnant 1 occurs at the northern end of the existing buildings on the site. The remnant is an isolated group of eight *Eucalyptus tereticornis* (Forest Red Gum) trees in an area 20 by 10 metres over previously cleared ground now dominated by introduced species *Cynodon dactylon*, *Chloris gayana*, *Sida rhombifolia*, *Bidens pilosa* (Cobblers Pegs), *Melinis repens* (Red Natal Grass) and *Phytolacca octandra* (Inkweed). This is probably a remnant of Hunter Lowland Redgum Forest, an ecological community listed as endangered under the TSC Act (NSW Scientific Committee 2003). The remnant is in poor condition, completely lacking a shrub layer and lacking all but one native species (*Hardenbergia violacea*, False Sarsaparilla) in the ground layer. It is also very small and isolated from other native vegetation.

Remnant 2 is approximately 60 by 30 metres in extent and occurs adjacent to the southern part of the western boundary of the site and includes a group of 12 large trees (*Corymbia maculata* Spotted Gum, *E. fibrosa* Broad-leaved Ironbark and E. *tereticornis*), amongst which the understorey has been highly modified both floristically and structurally by clearing and continued mowing. Two large piles of spoil have been dumped around some of the trees, but most of the area is maintained as mown grasses. The shrub layer consists of only scattered shrubs of *Eucalyptus* regeneration, *Acacia parvipinnula* (Silver-stemmed Wattle) and *Melaleuca decora* (White Feather Honeymyrtle), as well as the introduced weed *Ricinus communis*. The ground layer is dominated by the introduced species *Paspalum dilatautm*, *Sida rhombifolia*, *Bidens pilosa*, *Verbena bonariensis* (Purpletop), *Setaria gracilis*, *Plantago lanceolata* and the native species *Hardenbergia violacea* and *Dichondra* sp. A. This remnant is consistent with either Lower Hunter Spotted Gum – Ironbark Forest or Hunter Lowland Redgum Forest or the ecotone between them. Both of these communities are listed as Endangered Ecological Communities under the TSC Act (NSW Scientific Committee

2003, 2005), though the severe modification of the understorey layers makes it difficult to confirm this.

Remnant 3 occurs along the southern boundary, south of the existing buildings on the site. The remnant is approximately 70 by 40 metres in extent and includes three large trees (*C. maculata* and *E. fibrosa*) and a number of 10-20-metres high regrowth of *C. maculata*, *E. fibrosa* and *E. tereticornis*. A sparse shrub layer consists of few *Melaleuca decora*, *M. linearifolia* and *A. parvipinnula*. The ground layer is highly modified, being dominated by introduced grasses and weeds, particularly *Stenotaphrum secundatum* (Buffalo Grass), *Paspalum dilatatum*, *Ehrharta erecta* (Panic Veldtgrass), *Cynodon dactylon* and *Bidens pilosa*. This remnant is consistent with the Lower Hunter Spotted Gum–Ironbark Forest community listed as an Endangered Ecological Communities under the TSC Act (NSW Scientific Committee 2005). While very degraded remnant 3 has the potential to regenerate if maintained for such a purpose.

Remnants 2 and 3 retain marginal connectivity between each other through native shrub regeneration (or possibly plantings) around the banks of the existing effluent pond in the south-western corner of the site. These remnants are also within 100 metres of a large area of native forest on the western side of Kyle Street and are tenuously connected to an even larger area of native forest approximately 400 metres south-west of the site via a narrow, but continuous, north-south corridor of regrowth eucalypts along a constructed channel which runs through the industrial area to the south of the site.

Remnant 4 is situated near the north-eastern boundary of the site and comprises an approximately 80 by 40 metres area of *E. tereticornis*, *Angophora floribunda* (Rough-barked Apple) and *Brachychiton populneus* (Kurrajong) trees to 20 metres height and a small nearby clump of *Casuarina glauca* (Swamp Oak) trees. It retains a sparse native shrub layer of *Eucalyptus* and *Angophora* regeneration, *Callistemon salignus* (Willow Bottlebrush) and *Acacia parramattensis*. Ground cover is dense and includes the native species *Themeda australis* (Wallaby Grass) and *Viola hederacea*, but consists primarily of introduced species, predominantly *Paspalum dilatatum*, *Plantago lanceolata*, *Bidens pilosa*, *Chloris gayana*, *Cynodon dactylon* and *Verbena bonariensis*.

Remnant 4 is consistent with the Hunter Lowland Redgum Forest community listed as an Endangered Ecological Community under the TSC Act (NSW Scientific Committee 2003). Of the four remnants remnant 4 is in the best condition and though quite degraded has the potential to regenerate if maintained for such a purpose.

4.2 Plant populations and species

A total of 49 species of plant was recorded on site (Appendix C). Slightly more than half the recorded species (31) are introduced. No noxious weeds for the Maitland City local government area were recorded on site.

Threatened species are listed under the *TSC Act* and *EPBC Act*. The likelihood of occurrence of nine threatened plant species known from or possibly occurring within 20 kilometres of the site was considered, as shown in

Table 4.1, and species possibly occurring were targeted during survey. No threatened plant species was identified during the surveys. Based on targeted survey, habitat assessment and the known distribution of these species, none of the species are considered likely to be present on site.

Endangered populations are listed under Schedule 1 Part 2 of the TSC Act. No species of plant has an endangered population in the Maitland City local government area.

Table 4.1: Threatened plant species in the study locality

Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Occurrence on site?	Likely significant impact?
Rutidosis heterogama	V	V	2Va	Occurs in coastal districts from Maclean to the Hunter Valley and inland to the Torrington region. It grows mostly in heath and often along disturbed roadsides and has also been recorded in grassland and open forest (DLWC, 2001).	Possible, but poor quality habitat	No
Acacia bynoeana Bynoe's Wattle	E1	V	3V	Occurs south of Dora Creek-Morisset area to Berrima and the Illawarra region and west to the Blue Mountains. It grows mainly in heath and dry sclerophyll forest on sandy soils (Harden 2002).Seems to prefer open, sometimes disturbed sites such as trail margins and recently burnt areas. Typically occurs in association with Corymbia gummifera, Eucalyptus haemastoma, E. gummifera, E. parramattensis, E. sclerophylla, Banksia serrata and Angophora bakeri (NSW National Parks and Wildlife Service 1999).	No	No
Callistemon linearifolius	V		2Ri	Occurs chiefly from Georges to the Hawkesbury River where it grows in dry sclerophyll forest, open forest, scrubland or woodland on sandstone. Found in damp places, usually in gullies (Robinson 1994, Fairley and Moore 2002, Harden 2002). Within the Sydney region, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (NSW Scientific Committee 1999).	Possible, but poor quality habitat	No
Eucalyptus parramattensis ssp. decadens	V	V	2V	Locally frequent, grows in dry sclerophyll woodland on sandy soils in low, often wet sites (Harden 2002).	Possible, but poor quality habitat	No
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	3V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats (Harden 1993, NSW National Parks and Wildlife Service 1999).	No	No

Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Occurrence on site?	Likely significant impact?
Diuris pedunculata Small Snake Orchid	E1	E	2E	Occurs chiefly from Port Jackson to Tenterfield where it grows in moist grassy areas in sclerophyll forest (Harden 1993) typically on stony soils on low ridges or moist flats (Bishop 2000).	Possible, but poor quality habitat	No
Grevillea parviflora ssp. parviflora	V	V		Mainly known from the Prospect area (but now extinct there) and lower Georges River to Camden, Appin and Cordeaux Dam areas, with a disjunct populations near Putty, Cessnock and Cooranbong. Grows in heath or shrubby woodland in sandy or light clay soils usually over thin shales (NSW Scientific Committee 1998, Harden 2002).	Possible, but poor quality habitat	No
Persoonia pauciflora	E1			Known distribution extremely restricted . All known individuals occur within 2.5km of the original or type specimen, which was recorded near North Rothbury in the Cessnock Local Government Area. Occurs in dry open-forest or woodland habitats, generally with a projected foliage cover ranging between 10 to 40 percent and tree height range of between 6 to 18 metres. The lower strata usually comprises of a moderate to sparsely distributed shrub layer, with a high percentage of groundcover species, particularly grasses. Vegetation communities are dominated by Spotted Gum (Corymbia maculata), Broad-leaved Ironbark (Eucalyptus fibrosa), and/or Narrow-leaved Ironbark (E. crebra). Sub-dominant species include Grey Gum (E. punctata) and Grey Box (E. mollucana). Common understorey shrubs include Acacia parvipinnula, Daviesia ulicifolia and Bursaria spinosa. The majority of the population is known to occur on silty sandstone soils derived from the "Farley Formation"(Patrick 1999), (NSW National Parks and Wildlife Service 1999).	Possible, but poor quality habitat	No

Name	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Habitat	Occurrence on site?	Likely significant impact?
Tetratheca juncea	V	V	3Vi	Occurs in coastal districts from Bulahdelah to Port Macquarie where it grows in dry sclerophyll forest and occasionally swampy heath in sandy, (Harden 1992) low nutrient soils with a dense understorey of grasses. Specifically it is known to occur within Smooth-barked Apple Woodland and Coastal Foothills Spotted Gum Woodland (NSW National Parks and Wildlife Service 2000, 2000, 2000).	No	No

Notes:
1 TSC Act V= Vulnerable, E1 = Endangered; E2= Endangered Population, E4 = Presumed Extinct (Threatened Species Conservation Act 1995);
2 EPBC Act V = Vulnerable, E = Endangered, X = Extinct (Environment Protection and Biodiversity Conservation Act 1999)
3 ROTAP Rare or Threatened Australian Plants (Briggs and Leigh 1996) is a conservation rating for Australian plants. Codes are:
1 Species only known from one collection
2 Species with a geographic range of less than 100km in Australia
3 Species with a geographic range of more than 100km in Australia
X Species presumed extinct; no new collections for at least 50 years
E Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
V Vulnerable species at risk of long-term disappearance through continued depletion.
R Rare, but not currently considered to be endangered.
K Poorly known species that are suspected to be threatened.
C Known to be represented within a conserved area.
a At least 1,000 plants are known to occur within a conservation reserve(s).
i Less than 1,000 plants are known to occur within a conservation reserve(s).
- The reserved population size is unknown.
t The total known population is reserved.
+ The species has a natural occurrence overseas.

4.3 Animal populations and species

The 39 vertebrate animal species detected on site during general and targeted surveys are listed in Appendix D. These comprised one native species of amphibian, 30 native species of bird, one native species of mammals and three introduced bird and three introduced mammal species.

Threatened species are listed under the *TSC Act* or *EPBC Act* and migratory species are listed under the *EPBC Act*. The likelihood of occurrence of 63 threatened or migratory animal species known from within 20 kilometres of the site was considered, as shown in *Table 4.2*, and species possibly occurring were targeted during survey.

Only one threatened animal species, *Pteropus poliocephalus*, the Grey-headed Flying-fox, was detected during the survey. Four migratory bird species were detected during the surveys. These were the Black-shouldered Kite *Elanus axillaris*, Chestnut Teal *Anas castanea*, Masked Lapwing *Vanellus miles* and Australian Hobby *Falco longipennis*.

Endangered populations are listed under Schedule 1 Part 2 of the TSC Act. No species of animal has an endangered population in the Maitland City local government area.

Table 4.2: Threatened and migratory animal species in the study locality

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Amphibians						
Litoria aurea	Green and Golden Bell Frog	E1	V	Has a fragmented distribution of mainly near coastal locations from Lakes Entrance (Victoria) to south of the NSW-Queensland border, as far west as Bathurst in the more elevated southern tablelands and central slopes of NSW. Various types of habitat utilised have been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites. Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes. Habitat attributes associated with the various waterbodies occupied by the GGBF, and that appear to make such habitat more likely to be occupied, include that the water body is shallow, still or slow flowing, ephemeral and/or widely fluctuating, unpolluted and without heavy shading. Permanent waterbodies are also known to be used and there is historical evidence of occupation of large, often deep and permanent bodies of water. There is a clear preference shown by GGBF for sites with a complexity of vegetation structure and associated terrestrial habitat attributes that appear to favour the species include extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation and other cover, considered to be used for foraging and shelter. Over-wintering sites may be adjacent to or some distance away from breeding sites; such sites include the bases of dense vegetation tussocks, beneath rocks, timber, within logs or beneath ground debris, including human refuse such as sheet iron, but the full range of possible habitat used for this purpose is not yet well understood (Department of Environment and Conservation 2004, 2005).	No	No
Litoria brevipalmata	Green Thighed Frog	V		The species inhabits coastal forest and bushland from south-east QLD to Ourimbah NSW and breeding takes place only after heavy summer rains when calling males gather around temporary or semi-permanent ponds and flooded ditches. Egg masses are often laid in temporary ponds and their survival may depend on subsequent rains around grassy semi-permanent ponds in late spring and summer (Cogger 2000).	No	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Litoria littlejohni	Heath Frog	V	V	Distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats (NSW Scientific Committee 2000).	No	No
Mixophyes balbus	Stuttering Frog	E1	V	Terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (Cogger 2000, NSW Scientific Committee 2003).	No	No
Mixophyes iteratus	Giant Barred Frog	E1	E	Terrestrial species which occurs in rainforests, Antarctic beech or wet sclerophyll forests. Feeds on insects and smaller frogs (Cogger 2000). The species is associated with permanent flowing drainages, from shallow rocky rainforest streams to slow-moving rivers in lowland open forest. It is not known to utilise still water areas (NSW Scientific Committee 1999). More prevalent at lower altitudes and in larger streams than its congeners, although has been recorded up to 1000 metres asl. (NSW National Parks and Wildlife Service 1999).	No	No
Birds						
Anseranas semipalmata	Magpie Goose	V		Occurs in shallow wetlands such as large swamps and dams, especially with dense growth of rushes or sedges, and with permanent lagoons and grassland nearby. Feeds on seeds, tubers and green grass. Form large nesting colonies during the wet season. During the dry season this species migrates hundreds of kilometres to perennial swamps (Garnett and Crowley 2000, NSW National Parks and Wildlife Service 2002).	No	No
Botaurus poiciloptilus	Australasian Bittern	V		Occurs in shallow, vegetated freshwater or brackish swamps. Requires permanent wetlands with tall dense vegetation, particularly bulrushes and spikerushes. When breeding, pairs are found in areas with a mixture of tall and short sedges but will also feed in more open territory. (Garnett and Crowley 2000, NSW National Parks and Wildlife Service 2002).	No	No
Burhinus grallarius	Bush Stone-curlew	E1		Require sparsely grassed, lightly timbered, open forest of woodland. In southern Australia they often occur where there is a well structured litter layer and fallen timber debris. Feed on a range of invertebrates and small vertebrates, as well as seeds and shoots (NSW National Parks and Wildlife Service 1999, 2003).	No	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Occurs in eucalypt woodland and forest with Casuarina/Allocasuarina spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key Allocasuarina species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (NSW National Parks and Wildlife Service 1999, Garnett and Crowley 2000).	No	No
Climacteris picumnus	Brown Treecreeper	V		Occurs in eucalypt woodland and adjoining vegetation. Feeds on ants, beetles and larvae on trees and from fallen timber and leaf litter. Usually nests in hollows (Garnett and Crowley 2000).	Possible, but poor quality habitat	No
Ephippiorhynchus asiaticus	Black-necked Stork	E1		Feed in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett and Crowley 2000).	No	No
Erythrotriorchis radiatus	Red Goshawk	E1	VM	Lives in coastal and sub-coastal tall open forests and woodlands, tropical savannas traversed by wooded or forested rivers and along edges of rainforest. Nests are only built in trees taller than 20 meters which occur within 1 kilometre of a watercourse or wetland. Has a home range of 200 square kilometres and hunts for medium to large birds in open forests and gallery forest (Garnett and Crowley, 2000).	Possible, but poor quality habitat, for foraging only	No
Falco hypoleucos	Grey Falcon	V	M	Generally centred on inland drainage systems where the average rainfall is less than 500 millimetres. It is found in timbered lowland plains that are crossed by tree-lined water courses. Nests in the old nests of other birds, particularly raptors (Garnett and Crowley 2000).	Possible, but poor quality habitat, for foraging only	No
Gallinago hardwickii	Latham's Snipe		M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley 2000).	No	No
Grantiella picta	Painted Honeyeater	V		Lives in dry forests and woodlands. Primary food is the mistletoes in the genus Amyema, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley 2000).	No	No
Haematopus longirostris	Pied Oystercatcher	V		Occurs in undisturbed beaches, sandpits, sandbars, tidal mudflats, estuaries and coastal islands. Occasionally found on rocky reefs, shores, rock stacks, brackish or saline wetlands and also in grassy paddocks, golf courses or parks near coast. Eggs are laid in shallow scrape in sand on open beach or among low growth behind beach (Pizzey and Knight 1997).	No	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey and Knight 1997).	Possible, but poor quality habitat, for foraging only	No
Hamirostra melanosternon	Black-breasted Buzzard	V	M	Distributed throughout most of inland Australia and prefers arid scubland, and open woodlands. Feeds on small mammals and birds (Garnett and Crowley 2000).	No	No
Hirundapus caudacutus	White-throated Needletail		M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight 1997).	Possible, but flyover only	No
Irediparra gallinacea	Comb-crested Jacana	V		Occurs in floating vegetation of permanent well-vegetated wetlands and dams. Walks on floating plants. Occasionally feeds along muddy wetland margins on east coast of NSW (Garnett and Crowley 2000).	No	No
Ixobrychus flavicollis	Black Bittern	V		Usually found in dense vegetation in and fringing streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Feeds on aquatic fauna along streams, in estuaries and beside billabongs and pools. Breeding occurs in summer in secluded places in densely vegetated wetlands. It nests in trees that overhang the water (Garnett and Crowley 2000, NSW National Parks and Wildlife Service 2002).	No	No
Lathamus discolor	Swift Parrot	E1	EM	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett and Crowley 2000),(Swift Parrot Recovery Team 2001).	Possible, but poor quality habitat, for migratory foraging only	No
Lophoictinia isura	Square-tailed Kite	V	M	This species hunts primarily over open forest, woodland and mallee communities as well as over adjacent heaths and other low scrubby habitats in wooded towns. It feeds on small birds, their eggs and nestlings as well as insects. Seems to prefer structurally diverse landscapes (Garnett and Crowley 2000).	Possible, but poor quality habitat, for foraging only	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Melanodryas cucullata	Hooded Robin	V		Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Garnett and Crowley 2000, Traill and Duncan 2000).	Possible, but poor quality habitat	No
Melithreptus gularis gularis	Black-chinned Honeyeater	V		Found in dry eucalypt woodland particularly those containing ironbark and box. Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett and Crowley 2000).	Possible, but poor quality habitat	No
Monarcha melanopsis	Black-faced Monarch		M	Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating (Pizzey and Knight 1997).	Possible, but poor quality habitat, for migratory foraging only	No
Monarcha trivirgatus	Spectacled Monarch		M	Occurs in the understorey of mountain/lowland rainforests, thickly wooded gullies and waterside vegetation. Migrates to NE NSW in summer to breed (Pizzey and Knight 1997).	Possible, but poor quality habitat, for migratory foraging only	No
Myiagra cyanoleuca	Satin Flycatcher		M	Occurs in heavily vegetated gullies, in forests and taller woodlands. During migration it is found in coastal forests, woodlands, mangroves, trees in open country and gardens (Pizzey and Knight 1997).	Possible, but poor quality habitat, for migratory foraging only	No
Neophema pulchella	Turquoise Parrot	V		Occurs in the foothills of the great dividing range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey. Nests in hollows in trees, stumps or even fence posts. It feeds on seeds of both native and introduced grass and herb species (Garnett and Crowley 2000).	Possible, but poor quality habitat, for migratory foraging only	No
Ninox connivens	Barking Owl	V		Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley 2000).	Possible, but poor quality habitat, for foraging only	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Ninox strenua	Powerful Owl	V		A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley 2000).	Unlikely, and possible, poor quality habitat, for foraging only	No
Oxyura australis	Blue-billed Duck	V	M	Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, Lignum (Muehlenbeckia cunnighamii) and paperbark (Melaleuca) (Garnett and Crowley 2000).	No	No
Pandion haliaetus	Osprey	V	M	Generally a coastal species, occurring in estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Sometimes ascends larger rivers to far inland. Builds nests high in tree, on pylon or on ground on islands. Feeds on fish (Pizzey and Knight 1997).	Possible, but poor quality habitat, for foraging only	No
Pomatostomus temporalis	Grey-crowned Babbler	V		Found throughout wetsern slopes and plains, southern and central tablelands and occurring in Northern Rivers area, mid-north coast and the Hunter Valley of NSW. Lives in open forest and woodland, Acacia shrubland and adjoining farmland. Large stick dome nest with spout-like entrance (Pizzey and Knight 1997).	Possible, but poor quality habitat	No
Ptilinopus magnificus	Wompoo Fruit-Dove	V		Occurs in rainforests, monsoon forests, adjacent eucalypt forests, fruiting trees on scrubby creeks or in open country (Garnett and Crowley 2000).	No	No
Pyrrholaemus sagittata	Speckled Warbler	V		Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett and Crowley 2000).	Possible, but poor quality habitat	No
Rhipidura rufifrons	Rufous Fantail		M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Pizzey and Knight 1997).	Possible, but poor quality habitat, for migratory foraging only	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Rostratula benghalensis	Painted Snipe	E1	VM	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as Eucalyptus camaldulensis (River Red Gum), E. populnea (Poplar Box) or shrubs such as Muehlenbeckia florulenta (Lignum) or Sarcocornia quinqueflora (Samphire). Feeds at the water's edge and on mudflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett and Crowley 2000).	No	No
Stagonopleura guttata	Diamond Firetail	V		Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range. Feed on seeds, mostly of grasses (Garnett and Crowley 2000).	Possible, but poor quality habitat	No
Sterna albifrons	Little Tern	E1	M	A coastal species found along the coast of New South Wales. They nest between the high tide mark and shore vegetation on undisturbed and non-vegetated sites near estuaries and adjacent freshwater lakes. They feed on fish taken from inshore waters (Garnett and Crowley 2000).	No	No
Stictonetta naevosa	Freckled Duck	V	M	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests (Garnett and Crowley 2000).	No	No
Tyto capensis	Grass Owl	V		Typically found in tussock-grasslands but also occur in heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, grassy gaps between trees and crops. Nest on the ground generally under tussocks. They generally feed on rodents but will also eat insects (Garnett and Crowley 2000).	No	No
Tyto novaehollandiae	Masked Owl	V		Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley 2000).	No	No
Tyto tenebricosa	Sooty Owl	V		Occurs in wet eucalypt forest and rainforest on fertile soils with tall emergent trees. Typically found in old growth forest with a dense understorey but also occurs in younger forests if nesting trees are present nearby. It nests in large hollows within eucalypts and occasionally caves. It hunts in open and closed forest for a range of arboreal and terrestrial mammals including introduced species and sometimes birds (Garnett and Crowley 2000).	No	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Xanthomyza phrygia	Regent Honeyeater	E1	EM	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with Casuarina cunninghamiana and Amyema cambagei are important for feeding and breeding. Important food trees include Eucalyptus sideroxylon (Mugga Ironbark), E. albens (White Box) , E. melliodora (Yellow Box) and E. leucoxylon (Yellow Gum) (Churchill 1998).	Possible, but poor quality habitat, for migratory foraging only	No
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (NSW National Parks and Wildlife Service 1999).	Possible, but poor quality habitat, for foraging only	No
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999, 1999). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (Churchill 1998).	Possible, but poor quality habitat	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings (Strahan 1995).	Unlikely	No
Miniopterus australis	Little Bent-wing Bat	V		Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Churchill 1998).	Possible, but poor quality habitat, for foraging only	No
Miniopterus schreibersii	Eastern Bent-wing Bat	V	C	Usually found in well timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill 1998).	Possible, but poor quality habitat, for foraging only	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Mormopterus norfolkensis	Eastern Freetail-bat	V		Thought to live in sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998).	Possible, but poor quality habitat	No
Myotis adversus	Large-footed Myotis	V		Colonies occur in caves, mines, tunnels, under bridges and buildings. Colonies always occur close to bodies of water where this species feeds on aquatic insects (NSW National Parks and Wildlife Service 1999, 2003).	Possible, but poor quality habitat, for foraging only	No
Petaurus australis	Yellow-bellied Glider	V		Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide helter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999).	No	No
Petaurus norfolcensis	Squirrel Glider	V		Found in dry sclerophyll forest and woodland but not found in dense coastal ranges. Nests in hollows and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 2003).	Unlikely, and poor quality habitat, for foraging only	No
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	Occurs in inland and sub-coastal south eastern Australia where it inhabits rock slopes. It has a preference for rocks which receive sunlight for a considerable part of the day. Windblown caves, rock cracks or tumbled boulders are used for shelter. Occur in small groups or 'colonies' each usually separated by hundreds of metres (NSW National Parks and Wildlife Service 1999, 2003).	No	No
Phascogale tapoatafa	Brush-tailed Phascogale	V		Largely arboreal it occurs in a range of habitats which have reliable rainfall (500-2000mm), but has preference for open dry sclerophyll forest on ridges (up to 600 m alt) with little/sparse ground cover. It nests in tree hollows and feeds at dusk on arthropods and small vertebrates (Johnston 1995, NSW National Parks and Wildlife Service 1999).	Yes	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Phascolarctos cinereus	Koala	V		Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata, Monkey Gum E. cypellocarpa and Ribbon Gum E. viminalis. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured (Churchill 1998, NSW National Parks and Wildlife Service 2001).	Possible, but poor quality habitat	No
Potorous tridactylus	Long-nosed Potoroo	V	V	Disjunct distribution along coastal south-east Australia from near Gladstone in Queensland, to south-west Victoria and in Tasmania. Found from sea level up to 1500 metres in altitude generally in areas with rainfall greater than 760 millimetres. In NSW, it is found throughout coastal and subcoastal areas. Occurs in a range of habitats: coastal forest and woodland with a moderately dense heathy understorey, dense coastal scrubs or heath, wet and dry sclerophyll forest and sub-tropical, warm temperate and cool temperate rainforest of the eastern slopes and highlands. Often associated with gullies and forest ecotones. Open areas are used for foraging while areas of dense groundcover or understorey provide areas for shelter and protection from predators. Relatively thick ground cover is a major habitat requirement and it seems to prefer areas with light sandy soils. Feeds at dusk on roots, tubers, fungi, insects and their larvae and other soft bodied animals in the soil. Moves up and down slope as food resources become seasonally available (Churchill 1998).	Possible, but poor quality habitat	No
Pseudomys oralis	Hastings River Mouse	E1	E	Recent sightings of the species have been made near low creek banks in tall, open eucalypt forest with dense ground cover of sedges, grasses and/or ferns.	No	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (Department of Environment and Conservation 2005).	Yes, but poor quality habitat, for foraging only	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill 1998)	Possible, but poor quality habitat, for foraging only	No

Scientific Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Occurrence on site?	Likely significant impact?
Scoteanax rueppellii	Greater Broad-nosed Bat	V		The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Hunter Catchment Management Trust 2003).	Possible, but poor quality habitat, for foraging only	No
Reptiles						
Hoplocephalus bitorquatus	Pale-headed Snake	V		Found in a range of habitats from rainforest and wet sclerophyll forest to the drier eucalypt forests of the western slopes. Feeds largely on frogs and lizards (Cogger, 2000).	Possible, but poor quality habitat, for foraging only	No

Notes:
1 TSC Act V= Vulnerable, E1 = Endangered (Threatened Species Conservation Act 1995)
2 EPBC Act V = Vulnerable, E = Endangered, M = Migratory, C = Conservation Dependent (Environment Protection and Biodiversity Conservation Act 1999).

4.4 Fauna habitat

4.4.1 General

Fauna habitat values provided by the site generally reflect the condition of the vegetation communities as described above. While numerous bird species, including four migratory species, were observed (Appendix D), primarily in the native forest remnants, and one threatened species, the Grey-headed Flying Fox (*Pteropus poliocephalus*) was observed foraging at night in flowering Spotted Gums (*Corymbia maculata*), there is not a wide variety of fauna habitats present within the site. The highly simplified structure and low diversity of the vegetation present on the site and the low number (less than 20) of mature trees, only a few of which were beginning to develop hollows, significantly reduces its habitat value for woodland birds, microchiropteran bats and other arboreal mammals.

Furthermore, remnants 1 and 4 are isolated by more than 100 metres from other remnants or other areas of native vegetation outside the side. However, as discussed in Section 4.1, remnants 2 and 3 are proximate and retain some connectivity to each other as well as to larger areas of native vegetation outside the site. Furthermore, remnant 3 has potential to be easily regenerated. These factors increase their value as habitat.

Alone each of the remnants provides fauna habitat of low quality for fauna, but there is value in retaining them as remnants for fauna habitat in a landscape. Such trees can provide animals with hollows for shelter and nectar and pollen for food. They can also act as 'stepping stones' for animals moving from one area of bushland to another. Individual trees can also be an important seed source for regeneration (NSW Scientific Committee 2005).

4.4.2 Critical habitat

Critical Habitat is listed under both the *TSC Act* and *EPBC Act* and the Directors General of both State and Federal relevant departments maintain a register of this habitat. Critical habitat is the whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an Endangered Ecological Community that is critical to the survival of the species, population or ecological community (NPWS, 1996).

There is no listed critical habitat within the site or study area and none is likely to be affected by the proposed development.

4.4.3 SEPP 44 – Koala habitat

The site is located in the Maitland City local government area which is listed under Schedule 1 of State Environmental Planning Policy - 44 Koala Habitat Protection (SEPP-44). The site includes one preferred Koala feed tree species listed in Schedule 2 of the policy, being *Eucalyptus tereticornis* (Forest Red Gum). However, the site does not contain a density of Koala feed trees that would meet the SEPP-44 definition of core or potential Koala habitat. The site does not contain significant habitat for the Koala and the proposal does not require further consideration of SEPP-44.

4.5 Conservation significance

As described in Section 4.1, the site provides habitat for two vegetation communities – Lower Hunter Spotted Gum—Ironbark Forest and Hunter Lowland Redgum Forest – listed as threatened (endangered) at the state level under the *TSC Act*.

5. Impact and amelioration

5.1 Impacts of the proposal

5.1.1 Vegetation clearing and removal of debris

The proposal involves the complete removal of a maximum of approximately 0.8 hectares of vegetation that meet the definitions of Endangered Ecological Communities listed under the NSW *Threatened Species Conservation Act*. In addition, potentially important habitat features such as trees that have or have the potential to form hollows and ground debris will be removed.

The field assessment, however, identified few tree hollows presently occurring, although several of the large trees in remnants 2 and 3 are beginning to develop them. Likewise, there is little ground debris in the remnants and the vegetation within them is not structurally complex with shrub layers being generally absent.

5.1.2 Fragmentation, edge effects and reduced connectivity

As discussed in Section 4.4.1 two of the four remnants of native vegetation to be cleared (remnants 1 and 4) are already separated by considerable distance from the other remnants and other areas of native vegetation in the locality. The remaining two remnants (remnants 2 and 3) are somewhat connected to larger areas of forest or woodland habitat to the east and south, but being already at the edges of these larger patches their removal will not increase fragmentation of or edge effects on remaining native vegetation.

However, the proposal is likely to impact negatively on connectivity between remnants of native vegetation in the locality as the remnants within the site could function as important elements for the movement and dispersal of wildlife in a landscape that has been substantially cleared for grazing, coal mining and industrial and residential development and has a low proportion of native vegetation remaining (Department of Environment and Conservation 2005). As a likely consequence of continuing habitat loss and degradation of Lower Hunter Spotted Gum–Ironbark Forest, local bird observers have noted declines in species associated with spotted gum/ironbark forests, including the Swift Parrot, Regent Honeyeater, Brown Treecreeper, Black-chinned Honeyeater, Diamond Firetail, Turquoise Parrot, Fuscous Honeyeater, Eastern Shriketit and Spotted Quailthrush (NSW National Parks and Wildlife Service 1996). As discussed in Section 4.4.1 such remnants and even isolated trees can provide animals with hollows for shelter and food resources. They can also act as 'stepping stones' for animals moving from one area of bushland to another and for the dispersal of plants and as important seed sources for vegetation regeneration (Department of Environment and Conservation 2005).

5.1.3 Weeds

The site is already highly weed-infested and the proposed development may have high potential for promoting the dispersal and establishment of weed species. Appropriate measures need to be implemented during construction to minimise the spread of weeds from this area into the site and adjacent areas, especially into adjacent and proximate areas of native vegetation.

5.1.4 Key threatening processes

Key threatening processes to threatened populations, species and ecological communities are listed under Schedule 3 of the *TSC Act* and also under the *EPBC Act*. Clearing of native vegetation is listed as a key threatening process under the *TSC Act* and land clearance is listed under the *EPBC Act*. Removal of dead wood, dead trees and logs is listed as a key threatening process under the *TSC Act*.

The proposed action involves both the clearing of native vegetation and the removal of dead wood, dead trees and logs.

5.2 Impacts on species, populations and communities of conservation concern

5.2.1 Threatened ecological communities

The presence within the site of remnants of two Endangered Ecological Communities listed under the *Threatened Species Conservation Act 1995* – Lower Hunter Spotted Gum–Ironbark and Hunter Lowland Redgum Forest – has been determined. Under the current proposal these remnants are to be cleared.

Impact assessments for the threatened species concluded that the proposal would not have a significant impact on threatened species or populations An assessment of significance of the impact of this proposal on these Endangered Ecological Communities has been carried out under the *TSC Act* guidelines (Lower Hunter and Central Coast Regional Environmental Management Strategy 2003, NSW Scientific Committee 2003) and is shown as Appendix E. This assessment has determined that the proposal is unlikely to have a significant impact on those Endangered Ecological Communities.

5.2.2 Threatened flora species

As discussed in Section 1.1, no threatened plant species was detected during the surveys and it is considered unlikely that any threatened plant species is present on site. The proposal is therefore considered unlikely to impact significant on any threatened plant species.

5.2.3 Threatened fauna and migratory species

As discussed in Section 1.1, one threatened mammal and four migratory bird species were detected during the surveys. Other species are considered unlikely to be present on site. However, even if utilising the site, no threatened or migratory species is considered to be significantly affected by the proposal for one or more of the following reasons:

- core habitats were not recorded in the study area;
- the area is outside the normal range of the species and records are likely to be of vagrants or invalid;
- the species is considered locally extinct;
- resources used by the species are unlikely to be adversely affected, or only likely to be minimally affected by the proposal; or
- for migratory species the site is not classed as 'important habitat' as defined under the administrative significance guidelines of the EPBC Act, in that it does not contain:
  - habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
  - habitat utilised by a migratory species which is at the limit of the species range; or
  - habitat within an area where the species is declining.

Hence, although removal of vegetation has a negative impact in terms of habitat values, the amount of vegetation to be removed is unlikely to significantly affect the habitats of threatened animals that are likely to occur in the study area.

5.3 Impact amelioration

This assessment has determined that the proposal is unlikely to have a significant impact on endangered or vulnerable species, endangered populations or Endangered Ecological Communities.

However, in order to minimise impacts on ecological values of the site, a number of recommendations follow. The recommendations follow general principles of environmental management to, in order of preference

- **avoid** environmental impacts;
- **minimise** impacts;
- **mitigate** the impacts; and
- as a last resort once the above options have been investigated, **compensate** for the residual impacts.

It is therefore recommended that;

- consideration be given to modifying the proposal so that some or all of the remnant Endangered Ecological Communities are retained unaffected;
- if some of the remnant areas of Endangered Ecological Communities are unavoidable to clear, consideration should be given to off-setting the impact of the proposal by retaining and rehabilitating other remnants. Not only would this minimise the impacts of the proposal on biodiversity, but it would provide benefits to the site such as
  - providing visual and sound barriers between the site and neighbouring industrial premises;
  - improving the amenity of the worksite for staff.
- colour tape or 'parawebbing' should be used to delineate the maximum work area permitted. This should be implemented prior to any work commencing on site. If any tape is disturbed then it should immediately be replaced along the appropriate alignment;
- a clearing management plan should be prepared and implemented including inspection of tree hollows. The clearing protocols should include the following:
  - shaking the tree using a bulldozer;
  - slowly pushing the tree to the ground so that it largely remains intact;
  - leaving the tree in place once felled for at least one day/night before removing to allow animals to relocate to nearby vegetation;
  - all contractors having the contact numbers of wildlife rescue groups should animals be injured during clearing.
- sediment control devices should be installed prior to clearing vegetation to ensure that no impacts affect surrounding vegetation or creeks.
- control measures need to be implemented to ensure that weed species are not further promoted into retained native vegetation areas on site or in adjacent lands.

6. References

Anderson, R. H. 1961. Introduction. Contributions from the New South Wales National Herbarium Flora Series **1-18**:1-15.

Anderson, R. H. 1968. The Trees of New South Wales. Government Printer, Sydney.

Bishop, T. 2000. Field guide to the orchids of New South Wales and Victoria, Second edition. University of New South Wales Press Ltd. Pty., Sydney.

Briggs, J. D., and J. H. Leigh. 1996. Rare or Threatened Australian Plants. CSIRO, Canberra.

Churchill, S. 1998. Australian Bats. Reed New Holland, Sydney.

Cogger, H. G. 2000. Reptiles and Amphibians of Australia. Reed Books, Sydney.

Department of Environment and Conservation. 2004. Green and Golden Bell Frog threatened species information and environmental impact assessment guidelines. Department of Environment and Conservation (NSW), Hurstville.

Department of Environment and Conservation. 2005. Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*). *in*. Department of Environment and Conservation (NSW), Hurstville, NSW.

Department of Environment and Conservation. 2005. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion as an endangered ecological community: an overview. *in*, http://www.nationalparks.nsw.gov.au/npws.nsf/Content/hunter_gum_ironbark_endangered_factsheet.

Department of Environment and Heritage. 2005. Protected Matters Search Tool. *in*. Department of Environment and Heritage, Canberra.

Environment Australia. 2000. EPBC Administrative Guidelines on Significance. Department of Environment and Heritage, Canberra.

Fairley, A., and P. Moore. 2002. Native plants of the Sydney district. An identification guide, Revised Edition edition. Kangaroo Press, Sydney.

Garnett, S., and G. M. Crowley. 2000. The Action Plan for Australian Birds. Environment Australia, Canberra.

Harden, G. 1992. Flora of New South Wales Volume 3. University of New South Wales Press Ltd., Kensington.

Harden, G. 1993. Flora of New South Wales Volume 4. University of New South Wales Press Ltd., Kensington.

Harden, G. 2000. Flora of New South Wales Volume 1 (Revised Edition). University of New South Wales Press Ltd., Kensington.

Harden, G. 2002. Flora of New South Wales Volume 2 (Revised Edition), 2nd edition. University of New South Wales Press Ltd., Kensington.

Hunter Catchment Management Trust. 2003. Hunter Bushland Resource Kit: A guide to managing vegetation on private land in the Hunter catchment.

International Union for the Conservation of Nature. 2001. IUCN Red List of Threatened Species: 2001 Categories and Criteria (v. 3.1). International Union for the Conservation of Nature, Gland, Switzerland.

Johnston, P. G. 1995. Long-nosed Potoroo. Pages 301-302 *in* R. Strahan, editor. The Mammals of Australia. Reed New Holland, Sydney.

Lower Hunter and Central Coast Regional Environmental Management Strategy. 2002. Flora and fauna survey guidelines, Lower Hunter and Central Coast Region, 2002, Volume 1. Lower Hunter and Central Coast Regional Environmental Management Strategy, NSW.

Lower Hunter and Central Coast Regional Environmental Management Strategy. 2003. Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy Technical Report 2003, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map. Lower Hunter and Central Coast Regional Environmental Management Strategy, Callaghan, NSW.

Lower Hunter and Central Coast Regional Environmental Management Strategy. 2003. Lower Hunter Central Coast Extant Vegetation Community Map. Lower Hunter and Central Coast Regional Environmental Management Strategy, Thornton.

NSW National Parks and Wildlife Service. 1996. Threatened species assessment under the *Environment Planning and Assessment Act*: The '8 part test' of significance. Information circular No. 2. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1996. Threatened Species Assessment under the EP&A Act: The '8 Part test' of Significance. Information Circular No 2: NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. *Acacia bynoeana* threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Bush Stone-curlew threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Glossy Black-cockatoo threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Koala threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. *Persoonia pauciflora* threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Spotted-tailed Quoll threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Squirrel Glider threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 1999. Terms of licence under the Threatened Species Conservation Act 1995. Appendix B of the Integrated Forestry Operations Approval for the Upper North East Region. *in*.

NSW National Parks and Wildlife Service. 1999. Yellow-bellied Glider threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2000. *Tetratheca juncea* threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2000. *Tetratheca juncea* environmental impact assessment guidelines. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2000. Vegetation Survey, Classification and Mapping - Lower Hunter and Central Coast Regional Environment Managment Strategy. Lower Hunter and Central Coast Regional Environment Managment Strategy (LHCCREMS), Sydney.

NSW National Parks and Wildlife Service. 2001. Grey-headed Flying Fox threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2002. Native vegetation of the Cumberland Plain. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2002. Threatened Species of the Upper North Coast of New South Wales - Fauna. NSW National parks and Wildlife Service, Northern Directorate, Coffs Harbour.

NSW National Parks and Wildlife Service. 2003. Brush-tailed Rock Wallaby Warrumbungles endangered population threatened species information. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2003. Draft Recovery Plan for the Bush Stone-curlew *Burhinus grallarius*. National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2003. Draft Recovery Plan for the Koala. NSW National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service. 2003. Recovery Plan for the Yellow-bellied Glider (*Petaurus australis*). NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 1998. Final determination to list *Grevillea parvilfora* ssp. *parviflora* as a vulnerable species. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 1999. Final determination to list *Callistemon linearifolius* as a vulnerable species. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 1999. Final determination to list the Giant Barred Frog as an endangered species. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 2000. Final determination to list Littlejohn's tree Frog as a vulnerable species. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 2003. Final determination to list Hunter Lowland Redgum Forest as an Endangered Ecological Community. NSW Department of Environment and Conservation, Hurstville.

NSW Scientific Committee. 2003. Final determination to list the Stuttering Frog as an endangered species. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 2005. Final determination to list Lower Hunter Spotted Gum - Ironbark Forest as an Endangered Ecological Community. *in*. NSW Department of Environment and Conservation, Hurstville.

Patrick, G. 1999. Initial flora survey to sample potential habitat: abundance and distribution of the new plant species Persoonia ŧNorth Rothburyŧ. Report prepared for the NPWS, Hurstville.

Pizzey, G., and F. Knight. 1997. Field guide to the birds of Australia. Angus and Robertson, Sydney.

Robinson, L. 1994. Field guide to the native plants of Sydney. Kangaroo Press, Sydney.

Royal Botanic Gardens. 2004. PlantNet - The Plant Information Network System of Botanic Gardens Trust (version 2.0). *in*. Royal Botanic Gardens, Sydney.

Strahan, R. 1995. The Mammals of Australia. Reed New Holland, Sydney.

Swift Parrot Recovery Team. 2001. Swift Parrot Recovery Plan. *in* W. a. E. T. Department of Primary Industries, editor. Department of Primary Industries, Water and Environment, Hobart.

Thackway, R., and I. D. Cresswell. 1995. An Interim Biogeographic Regionalisation of Australia. Australian Nature Conservation Agency, Canberra.

Traill, B. J., and S. Duncan. 2000. Status of birds in the New South Wales temperate woodlands region. Consultancy report to the NSW National Parks and Wildlife Service by the Australian Woodlands Conservancy, Chiltern, Victoria.

Appendix A

Curricula vitae of project team

This appendix details the qualifications and experience of team members involved in the current project.

NICHOLAS CORKISH

Ecologist

Years of Experience

9 (6 months with PB, 9 with others)

Date of Birth	Nationality	Languages
15 September 1965	Australian	English

Residence

Australia

Education

Bachelor of Forest Science, University of Melbourne; Graduate Diploma in Science (Biological Science), University of Wollongong (currently enrolled)

Professional Affiliations

Ecological Society of Australia, Member

Key Qualifications

Nick has the equivalent over nine fulltime years practical experience in biodiversity, soil and water conservation and management. Nick's experience covers a number of aspects of native vegetation resource use and conservation issues, especially of native forests, and he has particular knowledge of biodiversity survey and conservation management for threatened species.

A considerable portion of Nick's work over the past 10 years has engaged him in assisting, conducting and managing a number of general or targeted surveys for both vegetation and vertebrate fauna. His field experience covers a range of habitats, primarily forests and woodlands, from coastal and tablelands areas of New South Wales and Victoria. Nick maintains particular interests in botany, plant ecology and fire ecology.

Nick is experienced in the assessment and mitigation of impacts, especially from timber harvesting, clearing, roads, infrastructure development, prescribed burning and wildfires. He has comprehensive theoretical and practical understanding of the conservation significance of threatened flora, fauna and of wildlife habitat and is knowledgeable in application of Federal and State environmental legislation including the *Environment Protection and Biodiversity Conservation Act* 1999, the *Threatened Species Conservation Act* 1995 and the *Environmental Planning and Assessment Act* 1979.

Nick also has considerable experience in the use of Geographic Information System products for mapping, data analysis, management, and planning purposes.

PB Experience

Impact Assessment, Options and Constraints Assessment

- Augmentation of the Northwest Sector Electricity Transmission Network, Riverstone (NW Sydney), NSW, Integral Energy. Assessed potential impacts of a number of route options on terrestrial flora and fauna and habitats, including endangered ecological communities of the Cumberland Plain. Survey for threatened flora and fauna and assessment of impacts of infrastructure proposed on preferred option.
- North Coast Rail Loops Preliminary Assessment and Scoping and Legislative Review, sixteen locations between Sydney and Brisbane, Australian Rail Track Corporation. Preliminary

assessment of flora and fauna and habitats, including endangered ecological communities, at sixteen proposed railway passing loops between Sydney and Brisbane.

- Terrestrial Flora and Fauna Assessment and Species Impact Statement of Proposed Bickham Coal Mine, Upper Hunter Valley, NSW, Bickham Coal Pty Ltd. Undertook and reported desktop studies, flora survey, vegetation community mapping (including definition and mapping of an endangered ecological community) and targeted terrestrial fauna surveys.
- Preliminary Ecological Issues Assessment and Legislative Review of Proposed Freight Train Support Facility, Singleton, NSW, Queensland Rail. Preliminary flora and fauna habitat assessment, including identification of endangered ecological communities.
- Environmental Impact Statement for Pacific Highway Upgrade, Kempsey to Eungai, NSW, Roads and Traffic Authority. Assessed terrestrial flora in endangered ecological floodplain communities and contributed to report on the likely impacts of the Pacific Highway Upgrade on terrestrial flora and fauna.
- Environmental Impact Statement for Lismore Sources Proposed Water Supply Pipeline and Associated Infrastructure, Lismore, NSW, Rous Water. Assessed the likely impacts of and constraints on the proposed water supply pipeline and associated infrastructure on terrestrial flora and fauna and habitats, including lowland rainforest on floodplain, an endangered ecological community.
- Environmental Impact Statement for Resource Recovery and Recycling Facility, Rutherford (Maitland), NSW, Transpacific Industries. Assessed the terrestrial flora and fauna and habitats and impacts of the proposed facilities on endangered ecological communities.

Management Planning, Conservation Planning

- Boggabri Coal Project Flora and Fauna Management Plan, Western NSW, Idemitsu Boggabri Coal Pty Ltd. Reviewed previous rehabilitation trials and researched information for a comprehensive flora and fauna management plan for the construction and operation of an open cut coal mine located within a State forest. Issues dealt with included threatened species and communities, weeds and pests, and rehabilitation. A monitoring program and baseline assessment was included in the plan.

Previous Experience

Ecological Monitoring

- Ecological Monitoring, NSW Mid-North Coast area, State Forests of NSW. Ecologist. Contributed to the development and implementation of projects to monitor impacts of native forest harvesting and associated road construction and prescribed burning activities on threatened flora species and the effectiveness of mitigation measures.

Conservation Planning and Impact Assessment

- Recovery Planning, NSW National Parks and Wildlife Service, Central Threatened Species Unit. Prepared separate recovery plans for threatened plant species *Zieria involucrata* and *Prostanthera askania* to meet requirements of both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Threatened Species Conservation Act 1995*.
- Vegetation Survey and Mapping, Warragamba Catchment, NSW National Parks and Wildlife Service, Conservation Assessment and Data Unit and Sydney Catchment Authority. Assisted the planning of, coordinated and implemented vegetation surveys with contract botanists.
- Vertebrate Fauna Survey, Avisford and Munghorn Nature Reserves, Mudgee Area, NSW National Parks and Wildlife Service, Conservation Assessment and Data Unit. Planned systematic vertebrate fauna surveys; participated with a small team of fauna surveyors and other field staff to carry them out; compiled, audited and managed the collected data; analysed, mapped and reported results of surveys.

- Vertebrate Fauna Survey, Warragamba Catchment, NSW National Parks and Wildlife Service, Conservation Assessment and Data Unit and Sydney Catchment Authority. Planned systematic vertebrate fauna surveys; led and coordinated a small team of specialist fauna surveyors and other field staff to carry them out; compiled, audited and managed the collected data.
- On-Ground Implementation of Conservation Measures in Timber Harvesting Areas. Bombala, Urunga and Mid-North Coast areas, State Forests of NSW. Forester/Ecologist. Oversaw the on-ground implementation in timber harvesting areas of conservation measures.
- Development and Implementation of Biodiversity Management Policies and Practices, Bombala, Urunga and Mid-North Coast areas, State Forests of NSW. Forester/Ecologist. Liaised and negotiated with external and internal stakeholders regarding the development and implementation of biodiversity management policies and practices.
- Vegetation and Threatened Flora and Fauna Surveys, Bombala, Urunga and Mid-North Coast areas, State Forests of NSW. Forester/Ecologist. Planned, coordinated and implemented vegetation and fauna surveys, assessed and reported results and ensured their incorporation into forest management.
- Timber harvesting planning, Bombala, Urunga and Mid-North Coast areas of NSW, State Forests of NSW. Forester/Ecologist. Collected baseline data on abiotic factors affecting or on biota affected by proposed timber harvesting operations; prepared detailed harvesting and road construction plans conforming to strict standards required for best practice and to meet regulatory and legislative requirements.

Publications

- Recovery plan for *Zieria involucrata*. Dept. of Environment and Conservation (NSW), 2004
- Recovery plan for *Prostanthera askania*. Dept. of Environment and Conservation (NSW), 2004.
- Fauna of the Munghorn Gap Nature Reserve. NSW National Parks and Wildlife Service, Central Directorate Conservation Assessment and Data Unit, 2003.
- Fauna of the Avisford Nature Reserve. NSW National Parks and Wildlife Service, Central Directorate Conservation Assessment and Data Unit, 2003.
- Co-author. Fire hazard and prescribed burning of thinning slash in eucalypt regrowth forest. *Management of Eucalypt Regrowth in East Gippsland Technical Report No.16.* Dept. of Conservation and Environment, Victoria and CSIRO Division of Forestry and Forest Products, ACT, 1991.

Professional History

2005 – present	Parsons Brinckerhoff Australia Pty. Ltd.
2001 – 2004	NSW National Parks and Wildlife Service/ Dept. of Environment and Conservation (NSW)
1993 – 2000	State Forests of New South Wales
1988 – 1990	Dept. of Conservation and Environment, Victoria

Appendix B

Accuracy of searched databases

This appendix details the types of data obtained from the Department of Environment and Conservation Atlas of NSW Wildlife and the EPBC Protected Matter Search Tool and the accuracy of both datasets.

Atlas of NSW Wildlife

The Atlas of NSW Wildlife is based on records of specific sightings. Each point is entered on a 1 km grid and hence location is only accurate to within 1 km. The Atlas of NSW Wildlife is not based on systematic surveys across New South Wales and the number of records is generally biased towards coastal sites and areas where people commonly visit, such as National Parks. It is also biased towards particular species, reserves and roads.

Department of Environment and Heritage Protected Matters Search Tool

The Department of Environment and Heritage Protected Matters Search Tool is based on predicted distributions compiled from a number of sources at various resolutions. Generally, where distributions are well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and detailed habitat studies. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps. For species whose distributions are less well known, point locations are collated from various sources and bioclimatic distribution models generated and then validated by experts. In some cases, distribution maps are based solely on expert knowledge.

The following species and ecological communities have not been mapped and do not appear in reports produced from the EPBC database:

- threatened species listed as extinct or considered as vagrants;
- some species and ecological communities that have only recently been listed;
- cetaceans which are not listed as threatened;
- some terrestrial species that overfly the Commonwealth marine area; and
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent.

Appendix C

Plants recorded on site

Appendix C: Plants recorded on site

This appendix details the plants recorded on site during the current surveys.

Scientific Name	Common Name	Indigenous to site?	TSC Act[1] / NPW Act[2]	EPBC Act[3]
Amygdalaceae				
Prunus sp.	Cherry or Plum	N		
Asteraceae				
Ambrosia sp.	Ragweed	N		
Aster subulatus	Wild Aster	N		
Bidens pilosa	Cobbler's Pegs	N		
Cirsium vulgare	Spear Thistle	N		
Conyza albida	Tall Fleabane	N		
Ozothamnus diosmifolius	White Dogwood	Y		
Senecio madagascariensis	Fireweed	N		
Sonchus oleraceus	Common Sowthistle	N		
Tagetes minuta	Stinking Roger	N		
Xanthium sp.	Burr	N		
Casuarinaceae				
Casuarina cunninghamiana	River Oak	N	P13	
Casuarina glauca	Swamp Oak	Y		
Casuarina sp.		N		
Convolvulaceae				
Dichondra sp.A		Y		
Euphorbiaceae				
Ricinus communis	Castor Oil Plant	N		
Fabaceae (Faboideae)				
Hardenbergia violacea	False Sarsaparilla	Y		
Trifolium repens	White Clover	N		
Fabaceae (Mimosoideae)				
Acacia parramattensis	Parramatta Wattle	Y		
Acacia parvipinnula	Silver-stemmed Wattle	Y		
Loranthaceae				
Dendrophthoe vitellina		Y		

Scientific Name	Common Name	Indigenous to site?	TSC Act[1] NPW Act[2]	EPBC Act[3]
Malvaceae				
Sida rhombifolia	Paddy's Lucerne	N		
Myrtaceae				
Angophora floribunda	Rough-barked Apple	Y		
Callistemon salignus	Willow Bottlebrush	Y		
Corymbia maculata	Spotted Gum	Y		
Eucalyptus fibrosa	Red Ironbark	Y		
Eucalyptus tereticornis	Forest Red Gum	Y		
Melaleuca decora	White Feather Honeymyrtle	Y		
Melaleuca linariifolia		Y		
Oleaceae				
Olea europaea	Common Olive	N		
Phytolaccaceae				
Phytolacca octandra	Inkweed	N		
Plantaginaceae				
Plantago lanceolata	Lamb's Tongues	N		
Poaceae				
Chloris gayana	Rhodes Grass	N		
Ehrharta erecta	Panic Veldtgrass	N		
Melinus repens	Red Natal Grass	N		
Panicum maximum var. maximum	Guinea Grass	N		
Paspalum dilatatum	Paspalum	N		
Cynodon dactylon	Couch Grass	N		
Setaria gracilis	Slender Pigeon Grass	N		
Sporobolus africanus	Parramatta Grass	N		
Stenotaphrum secundatum	Buffalo Grass	N		
Themeda australis	Kangaroo Grass	Y		
Proteaceae				
Grevillea robusta	Silky Oak	N		
Scrophulariaceae				
Verbascum sp.	Mullein	N		
Sterculiaceae				
Brachychiton populneus	Kurrajong	Y		
Ulmaceae				
Trema tomentosa var. viridis	Native Peach	Y		

Scientific Name	Common Name	Indigenous to site?	TSC Act[1] NPW Act[2]	EPBC Act[3]
Verbenaceae				
Lantana camara	Lantana	N		
Verbena bonariensis	Purpletop	N		
Violaceae				
Viola hederacea		Y		

Notes:
1 TSC Act V= Vulnerable, E1 = Endangered; E2= Endangered Population, E4 = Presumed Extinct (Threatened Species Conservation Act 1995);
National Parks and Wildlife Act P13 = Protected
2 EPBC Act V = Vulnerable, E = Endangered, X = Extinct (Environment Protection and Biodiversity Conservation Act 1999)
3 ROTAP Rare or Threatened Australian Plants (Briggs and Leigh 1996) is a conservation rating for Australian plants. Codes are:
1Species only known from one collection
2Species with a geographic range of less than 100km in Australia
3Species with a geographic range of more than 100km in Australia
XSpecies presumed extinct; no new collections for at least 50 years
E Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
VVulnerable species at risk of long-term disappearance through continued depletion.
R Rare, but not currently considered to be endangered.
K Poorly known species that are suspected to be threatened.
C Known to be represented within a conserved area.
aAt least 1,000 plants are known to occur within a conservation reserve(s).
i Less than 1,000 plants are known to occur within a conservation reserve(s).
- The reserved population size is unknown.
t The total known population is reserved.
+ The species has a natural occurrence overseas.

1: V= Vulnerable, E1 = Endangered (Threatened Species Conservation Act 1995),
2: V = Vulnerable, E = Endangered (Environment Protection and Biodiversity Conservation Act 1999)
3: ROTAP (Rare or Threatened Australian Plants, Briggs and Leigh 1996) is a conservation rating for Australian plants. Codes are:

1	Species only known from one collection
2	Species with a geographic range of less than 100km in Australia
3	Species with a geographic range of more than 100km in Australia
X	Species presumed extinct; no new collections for at least 50 years
E	Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
V	Vulnerable species at risk of long-term disappearance through continued depletion.
R	Rare, but not currently considered to be endangered.
K	Poorly known species that are suspected to be threatened.
C	Known to be represented within a conserved area.
a	At least 1,000 plants are known to occur within a conservation reserve(s).
i	Less than 1,000 plants are known to occur within a conservation reserve(s).
-	The reserved population size is unknown.
t	The total known population is reserved.
+	The species has a natural occurrence overseas.

Appendix D

Animals recorded on site

Appendix D: Animals recorded on site

This appendix details the animals recorded on site during the current and previous surveys.

Common Name	Scientific Name	Observation Type[1]	TSC Act[2]	EPBC Act[3]
Amphibians				
Common Eastern Froglet	*Crinia signifera*	O		
Native Birds				
Black-shouldered Kite	*Elanus axillaris*	O		*M*
Chestnut Teal	*Anas castanea*	O		*M*
White-necked Heron	*Ardea pacifica*	O		
Australian Magpie	*Gymnorhina tibicen*	O		
Dusky Woodswallow	*Artamus cyanopterus*	O		
Pied Butcherbird	*Cracticus nigrogularis*	O		
Galah	*Cacatua roseicapilla*	O		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O		
Masked Lapwing	*Vanellus miles*	O		*M*
Crested Pigeon	*Ocyphaps lophotes*	O		
Australian Raven	*Corvus coronoides*	O		
Magpie-lark	*Grallina cyanoleuca*	O		
Willie Wagtail	*Rhipidura leucophrys*	O		
Australian Hobby	*Falco longipennis*	O		*M*
Laughing Kookaburra	*Dacelo novaeguineae*	O		
Welcome Swallow	*Hirundo neoxena*	O		
Superb Fairy-wren	*Malurus cyaneus*	O		
Unidentified Fairy-wren	*Malurus sp.*	O		
Brown-headed Honeyeater	*Melithreptus brevirostris*	O		
Noisy Miner	*Manorina melanocephala*	O		
White-plumed Honeyeater	*Lichenostomus penicillatus*	O		
Golden Whistler	*Pachycephala pectoralis*	O		
Spotted Pardalote	*Pardalotus punctatus*	O		
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	O		
Double-barred Finch	*Taeniopygia bichenovii*	O		
Red-browed Finch	*Neochmia temporalis*	O		
Brown Quail	*Coturnix ypsilophora*	O		
Eastern Rosella	*Platycercus eximius*	O		
Red-rumped Parrot	*Psephotus haematonotus*	O		
Straw-necked Ibis	*Threskiornis spinicollis*	O		

Common Name	Scientific Name	Observation Type[1]	TSC Act[2]	EPBC Act[3]
Introduced Birds				
Rock Dove	*Columba livia*	O	*U*	
Common Myna	*Acridotheres tristis*	O	*U*	
Common Starling	*Sturnus vulgaris*	O	*U*	
Native Mammals				
Grey-headed Flying-fox	*Pteropus poliocephalus*	O	*V*	*V*
Introduced Mammals				
Dog (feral)	*Canis familiaris*	P	*U*	
Fox	*Vulpes vulpes*	O	*U*	
Rabbit	*Oryctolagus cuniculus*	O	*U*	

Notes:
1 Observation type: O = Observed, P = Indirect Evidence, L = Literature, W= Heard call.
2 TSC Act V= Vulnerable, E1 = Endangered (Threatened Species Conservation Act 1995)
3 EPBC Act V = Vulnerable, E = Endangered, M = Migratory, C = Conservation Dependent (Environment Protection and Biodiversity Conservation Act 1999).

Appendix E

Impact significance assessments

Lower Hunter Spotted Gum–Ironbark Forest in the Sydney Basin Bioregion

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions

Lower Hunter Spotted Gum–Ironbark Forest in the Sydney Basin Bioregion and Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions are listed as Endangered Ecological Communities under the *Threatened Species Conservation Act 1995*. This following is an assessment of significance of the impacts of the proposal on these Endangered Ecological Communities as required under the *TSC Act* ('Eight Part Test')

a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction

Not applicable

b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised

Not applicable

c) In relation to the regional distribution of a habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

It is estimated that prior to the colonisation of Australia, Lower Hunter Spotted Gum–Ironbark Forest was found in four large patches that covered nearly 50,000 hectares. This represented around 75 per cent of its total distribution. However, clearing and other disturbances have modified and greatly fragmented the community. Lower Hunter Spotted Gum–Ironbark Forest has been split into more than 4800 fragments, of which more than 4500 are less than 10 hectares in area. The four largest patches of the ecological community have been reduced to about 7000 hectares. This represents about 10 per cent of the community's estimated pre-European distribution (1996).

Modelling shows that much of the pre-1750 extent of the Hunter Lowland Redgum Forest community has been cleared. Less than 7100 ha (only about 38 per cent) of the original estimated area remains and this is highly fragmented and much is highly modified (Department of Environment and Conservation 2005).

Under the development proposal, four small remnants totalling approximately 0.8 hectares of these communities will be cleared and this area is not considered to be significant area.

d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

Under the development proposal, four small remnants totalling approximately 0.8 hectares of these communities will be cleared. Two of the remnants are isolated by more than 100 metres from other remnants or other areas of native vegetation outside the side. The other two remnants are proximate and retain some connectivity to each other as well as to larger areas of native vegetation outside the site.

Remnants 2 and 3 retain marginal connectivity between each other through native shrub regeneration (or possibly plantings) around the banks of the existing effluent pond in the south-western corner of the site. These remnants are also within 100 metres of a large area of native forest on the western side of Kyle Street and are tenuously connected to and even larger area of native forest approximately 400 metres south-west of the site via a narrow, but continuous, north-south corridor of regrowth eucalypts along a constructed channel which runs through the industrial area to the south of the site.

However, being already at the edges of these larger patches their removal is not considered to increase fragmentation of or edge effects on remaining native vegetation.

e) Whether critical habitat will be affected

Critical habitat is listed under the *TSC Act* and the Director General of the New South Wales Department of Environment and Conservation maintains a register of such habitat. Critical habitat is the whole or any part or parts of an area or areas of land comprising the habitat of an endangered species, an endangered population or an Endangered Ecological Community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2005).

Critical habitat has not been listed for these Endangered Ecological Communities and the site is unlikely to be critical for the survival of the community.

f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or similar protected areas) in the region

Only around 1600 hectares of Lower Hunter Spotted Gum–Ironbark Forest is protected within one conservation reserve (Werakata National Park) in which it comprises several fragmented patches of predominantly young regrowth. This is less than 2.5 per cent of the community's estimated pre-1750 distribution (NSW Scientific Committee 2005). The majority of the remainder of the community is not on public land.

Less than 2 per cent of the total original estimated area of Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is included in conservation reserves (Wereketa National Park). The majority of the remainder of the community is not on public land.

These communities are considered to be inadequately represented within conservation reserves.

g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process

Key Threatening Process are listed on Schedule 3 of the *TSC Act.* These communities are subject to a number of key threatening processes as well as other threats (Table I-1). In the Maitland local government area, these communities are exposed to high levels of threat from clearing for industrial and residential development, tree dieback and grazing. It is also moderately threatened by fragmentation, weeds, and fire (2003).

The proposed development will require a total of approximately 0.8 hectares of these communities to be cleared.

Table I-1: Recognised threats for Lower Hunter Spotted Gum–Ironbark Forest and Hunter Lowland Redgum Forest

Threat to community	Key Threatening Process	Threat likely to increase as a result of the proposal
Clearing of native vegetation	Yes	Yes
Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands	Yes	No
Invasion of native plant communities by exotic perennial grasses	Yes	No
Predation, habitat destruction, competition and disease transmission by feral pigs	Yes	No
Anthropogenic climate change	Yes	No
High frequency fire	Yes	No
Removal of dead wood and dead trees	Yes	Yes
Fragmentation and degradation	No	No
Landfilling and earthworks associated with urban and industrial developments	No	No
Altered fire frequecies	Yes	No
Pollution from urban and agricultural runoff	No	No
Grazing, trampling and other disturbance by domestic livestock and feral animals	No	No
Rubbish dumping	No	No
Hydrological changes in patterns of flooding and drainage following flood mitigation and drainage works, particularly the construction of drains, levees and flood gates	No	No
Weed invasion	No	Yes

h) Whether any threatened species, population or ecological community is at the limit of its known distribution

Lower Hunter Spotted Gum – Ironbark Forest is widespread throughout the central to lower Hunter Valley. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, Port Stephens and Dungog but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone. However, forests between Cessnock and Beresfield form the core of its distribution (NSW Scientific Committee 2003). According to mapping by the Lower Hunter and Central Coast Regional Environmental

Management Strategy (2003) the occurrence of the community in the subject site is not at the limits of its distribution.

Hunter Lowland Redgum Forest has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions . Mapping by the Lower Hunter and Central Coast Regional Environmental Management Strategy indicates that the occurrence of the community in the subject site is at the south-eastern limits of its distribution.

Conclusion

The proposed development will require the clearing of approximately 0.8 hectares of poor condition vegetation within these Endangered Ecological Communities. Mitigation measures will be put in place during construction to mitigate impacts. The proposed development is unlikely to have a significant impact on these communities.

References

Department of Environment and Conservation (2005). Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion as an Endangered Ecological Community: an overview.
http://www.nationalparks.nsw.gov.au/npws.nsf/Content/hunter_gum_ironbark_endangered_factsheet.

Lower Hunter and Central Coast Regional Environmental Management Strategy (2003). Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy Technical Report 2003, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map. Thornton, Lower Hunter and Central Coast Regional Environmental Management Strategy.

Lower Hunter and Central Coast Regional Environmental Management Strategy (2003). Lower Hunter Central Coast Extant Vegetation Community Map. Thornton, Lower Hunter and Central Coast Regional Environmental Management Strategy.

NSW National Parks and Wildlife Service (1996). Threatened Species Assessment under the EP&A Act: The '8 Part test' of Significance. Hurstville, Information Circular No 2: NSW National Parks and Wildlife Service.

NSW Scientific Committee (2003). Final determination to list Hunter Lowland Redgum Forest as an Endangered Ecological Community. Hurstville, NSW Department of Environment and Conservation.

NSW Scientific Committee (2005). Final determination to list Lower Hunter Spotted Gum - Ironbark Forest as an Endangered Ecological Community. Hurstville, NSW Department of Environment and Conservation.